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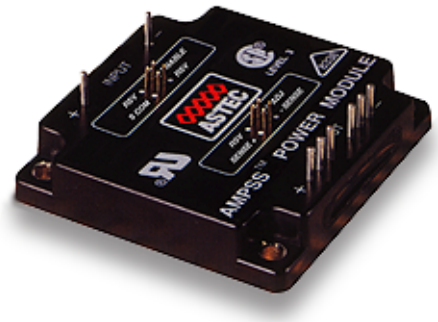
Jameco Part Number 188154

AMPSS™
Astec Modular Power Supply System

AK60A Economy Series



50-100W Output Power
DC-DC Converter Module
Technical Reference Manual

Series Highlights

- High Efficiency - up to 88%
- 100W Output Power
- Excellent transient response
- 85°C baseplate/case operating temperature
- Low output ripple and noise
- High Reliability - over 1 million hours MTBF
- Wide input voltage range
- Designed to meet Telecom specification
- Fixed switching frequency

ASTEC

Contents

Introduction 2
Special Features 2
Ordering Information 3
Safety 3

Electrical Specifications 4
Absolute Maximum Ratings – all models 4
Pin Connections - all models 5
Electrical Specifications for 24V Input Models (AK60A-024L-xxxFyy) 6
Insulation - all models 6
Electrical Specifications for 48V Input Models (AK60A-048L-xxxFyy) 8

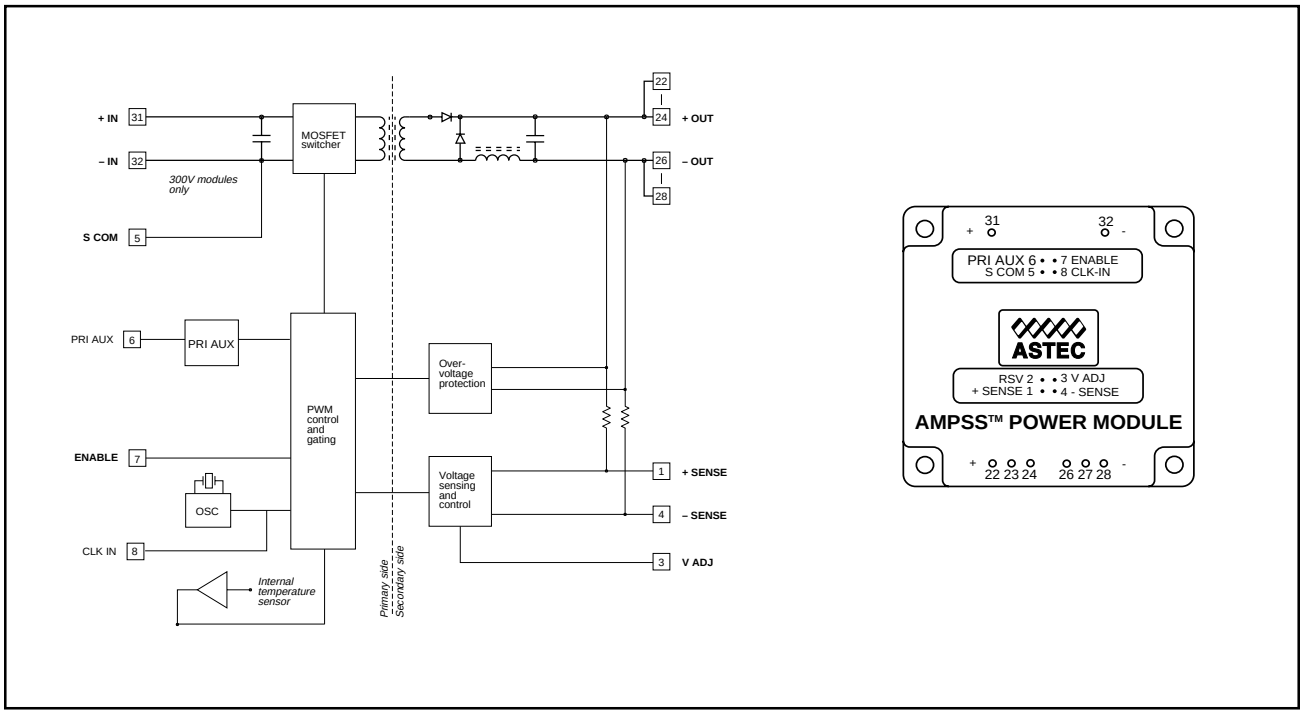
Functional Description 10
Remote Sense (+SENSE, -SENSE) 10
Enable Control (ENABLE) 10
PRI AUX 10
CLK IN 11
Output Voltage Adjustment (V ADJ) 12
Signal Common (S COM) 12

Design Considerations 13
Input Bulk Capacitors 13
Remote Loads 13
Input Undervoltage Protection 13
Conducted EMI 13
Output Ripple and Noise 13
Input Fusing 13
Break Regulation 14
Overtemperature Protection 14
MTBF 14
Thermal Data 14

Application Example 15

Mechanical Information 16
Dimensions 16
Recommended PCB Layout 17
Heatsink Mounting Information 18

AK60A Economy Series DC-DC Converters



Introduction

The AK60A is an isolated, single output DC to DC converter module, providing up to 100W output. The AK60A features primary side control, remote enable, remote sensing and a baseplate operating temperature of up to 85°C.

Special Features

- High Efficiency - up to 88%
- 500 KHz fixed frequency switching
- 85°C baseplate/case operating temperature (with no derating)
- Low output ripple and noise
- Excellent transient response
- High Reliability - over 1 million hours MTBF
- Wide input voltage range
- TTL compatible enable control
- Adjustable output voltage
- Overtemperature and short circuit protection

Ordering Information

Model Number	Input Voltage	Output Voltage	Output Current	Output Power
AK60A-048L-050F10	48V	5V	10A	50W
AK60A-048L-050F15	48V	5V	15A	75W
AK60A-048L-050F20	48V	5V	20A	100W
AK60A-048L-120F04	48V	12V	4.2A	50W
AK60A-048L-120F06	48V	12V	6.3A	75W
AK60A-048L-120F08	48V	12V	8.3A	100W
AK60A-048L-150F03	48V	15V	3.3A	50W
AK60A-048L-150F05	48V	15V	5.0A	75W
AK60A-048L-150F07	48V	15V	6.7A	100W
AK60A-024L-050F10	24V	5V	10A	50W
AK60A-024L-050F15	24V	5V	15A	75W
AK60A-024L-050F20	24V	5V	20A	100W
AK60A-024L-120F04	24V	12V	4.2A	50W
AK60A-024L-120F06	24V	12V	6.3A	75W
AK60A-024L-120F08	24V	12V	8.3A	100W
AK60A-024L-150F03	24V	15V	3.3A	50W
AK60A-024L-150F05	24V	15V	5.0A	75W
AK60A-024L-150F07	24V	15V	6.7A	100W
AK60A-024L-240F02	24V	24V	2.1A	50W
AK60A-024L-240F03	24V	24V	3.1A	75W
AK60A-024L-240F04	24V	24V	4.2A	100W

Please contact Astec for information on other output voltages, power ranges and configurations.

Safety

UL:	UL1950
CSA:	CSA C22.2 No.950
VDE:	VDE 0805 (48Vin only)
	EN60950 (48Vin only)
CE:	CE Mark (48Vin only)

Please contact Astec for information on specific module approvals.
Note: *Ensure all modules are used according to the Installation Instructions provided with each module.*

All modules are designed to meet the following specifications:

ETS300-132-2
ETS300-386-1(1)
EN55022-A(1)
EN55022-B(1)
EN41003
IEC6100-44(1)
IEC6100-45(1)
IEC950
VDE0871-A(1)
VDE0878-A(1)
BTNR2511(5)(1)

(1) Require additional external circuitry for full compliance. Please refer to application section of this manual or contact technical support office for further information.

Electrical Specifications

Absolute Maximum Ratings – all models

Exceeding the specified absolute maximum ratings may severely damage the module. These ratings are intended as guidelines for absolute worst case operating conditions and are not to be interpreted as recommended operating condition

General	48VInput	24V input
Continuous Input Voltage	72V	36V
Input Surge Voltage (1 sec)	75V (continuous)	38V
Isolation, Input to Output	1500VDC	1500VDC
Isolation, Input to Baseplate	1500VDC	1500VDC
Isolation, Output to Baseplate	500VDC	500VDC
Operating Temperature (Baseplate) / Case	-20 to 85˚C	
Storage Temperature	-40 to 105˚C	
Operating Relative Humidity (non-condensing)	10% to 95%	
Storage Relative Humidity (non-condensing)	95% Max	
Altitude (Operating)	< 3000m	
Altitude (Storage)	< 9000m	
Lead Temperature (soldering 5 Seconds)	235˚C	

Secondary Control Pins	
+SENSE	V_o - 0.5 to V_o + 0.5 VDC
-SENSE	-0.5 to 0.5 VDC
V ADJ	-0.5 to 7 VDC

Note : V_o = module output voltage
Note: Relative to -OUTPUT

Primary Control Pins	
ENABLE	-0.5 to 20 VDC
PRI AUX	-0.5 to 14VDC
CLK-IN	-10 to 10 VDC

Note: Relative to - INPUT/ S COM

Specifications

Electrical characteristics are guaranteed over the full baseplate/Case temperature range (-20 to 85˚C) and for the full range of input voltage (V_I) and for the full load range (I_{omin} to I_O rated). Except where indicated , +SENSE and -SENSE are connected to the output terminals at the point of measurement, ENABLE is connected toS COM. All other pins are left floating.

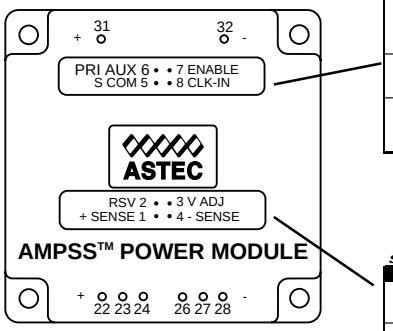
Definitions

V_I, V_O and I_O are actual operating conditions, V_{Inom}, V_{Onom} and I_{Orated} are nominal ratings.

Pin Connections - all models

INPUT PINS

Pin No	Pin Name	Type	Description	Recommended Connections
31	+INPUT	Input	Power input - positive	A 220µF electrolytic capacitor connected between the +INPUT and -INPUT pins is recommended
32	-INPUT	Input	Power input - negative (return)	See + INPUT for recommendations



PRIMARY CONTROL PINS

Pin No	Pin Name	Type	Description	Recommended Connections
5	S COM	Reference	Negative reference for all primary side signals	Connect to negative side of primary control and monitoring circuitry
6	PRI AUX	INPUT	Primary Auxiliary supply. Allows external capacitance or external auxiliary supply to be connected to the module to allow start-up into high capacitance loads	Normally not used. Leave unconnected. When required, connect capacitor to S-COM or connect external 12V auxiliary supply
7	ENABLE	INPUT	Enables or disables the output of the module	Must be connected to -S COM pin or driven to <0.8V to enable the output of the module
8	CLK-IN	INPUT	Accept a 500KHz input clock for synchronisation with host system or other modules	Connect to external clock signal. Leave unconnected if not used.

SECONDARY CONTROL PINS

Pin No	Pin Name	Type	Description	Recommended Connections
1	+SENSE	INPUT	Used for remote sense function to compensate for load bus resistance	If remote sensing is not required connect to +OUTPUT pins 22-24 of the module
2	RSV	-	Reserved	Leave unconnected
3	V ADJ	INPUT	Used to adjust module output voltage	Leave unconnected if not used
4	-SENSE	INPUT	Used for remote sense function to compensate for load bus resistance	If remote sensing is not required connect to -OUTPUT pins 26-28 of the module

OUTPUT PINS

Pin No	Pin Name	Type	Description	Recommended Connections
22-24	+OUTPUT	Output	Power output - positive	Ensure good electrical connection and sufficient copper on PCB layouts
26-28	-OUTPUT	Output	Power output - negative	See +OUTPUT for recommendations

CONTROL SIGNALS

Control Function	Conditions	Parameter	Min	Typ	Max	Units
V ADJ - voltage adjust	5V output: Connect 2.4KΩ from Vadj to +SENSE	V_O		90		$\%V_{Onom}$
	12V output: Connect 27KΩ from Vadj to +SENSE	V_O		90		$\%V_{Onom}$
	15V output: Connect 39KΩ from Vadj to +SENSE	V_O		90		$\%V_{Onom}$
	24V output: Connect 82KΩ from Vadj to +SENSE	V_O		90		$\%V_{Onom}$
	Connect to -SENSE	V_O		110		$\%V_{Onom}$
ENABLE - module enable	Module enabled	V_{ENABLE}	0		0.8	V
	Module disabled	V_{ENABLE}	2		10	V
	V_{ENABLE} = 0.8V	ENABLE current source			300	µA
PRI AUX	External Capacitor	External Capacitiance	0		2200	µF
		Capacitor voltage rating	25			V
	External Aux	Vcc	11.8	12.0	14	V
		Iaux current drawn from external supply		100	200	mA
CLK-IN	available at Rev2 or above module	$V_{CLK\ IN}$	4.4	5.0	5.5	V_{P-P}
		Clock Frequency		500		KHz
		Duty Cycle	49	50	51	%

Electrical Specifications for 24V Input Models *(AK60A-024L-xxxFyy)*

Insulation - all models

INSULATION

Parameter	Conditions	Min	Typ	Max	Units
Input-output insulation resistance	500VDC	10			MΩ
Input-baseplate insulation resistance	500VDC	10			MΩ
Output-baseplate insulation resistance	500VDC	10			MΩ

INPUT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Input voltage		18	24	36	V
Input surge voltage	(1 second)			38	V
Input low line power on voltage	Module power on	15.6		17.8	V
Input low line power off voltage	Module shutdown	8		13	V
Input capacitance				9	µF
Input current	Low line, nom V_O, max I_O				
	AK60A-024L-050F10		3.5		A
	AK60A-024L-050F15		5.4		A
	AK60A-024L-050F20		7.5		A
	AK60A-024L-120F04		3.5		A
	AK60A-024L-120F06		5.2		A
	AK60A-024L-120F08		7.2		A
	AK60A-024L-150F03		3.5		A
	AK60A-024L-150F05		5.2		A
	AK60A-024L-150F07		7.0		A
	AK60A-024L-240F02		3.5		A
	AK60A-024L-240F03		5.1		A
	AK60A-024L-240F04		6.9		A

TRANSIENT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Turn-on time	V_I = 0 to V_{Inom}			1	sec
Transient response	Step-load excursion			10	$\%V_O$
(25% to 75% load change @ 0.1A/µS, recovery to 1% V_O)	Step-load response			500	µS

Electrical Specifications for 24V Input Models *(Cont'd)*

OUTPUT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Nominal (factory set) output voltage					
	AK60A-024L-050F10		5.0		V
	AK60A-024L-050F15		5.0		V
	AK60A-024L-050F20		5.0		V
	AK60A-024L-120F04		12.0		V
	AK60A-024L-120F06		12.0		V
	AK60A-024L-120F08		12.0		V
	AK60A-024L-150F03		15.0		V
	AK60A-024L-150F05		15.0		V
	AK60A-024L-150F07		15.0		V
	AK60A-024L-240F02		24.0		V
	AK60A-024L-240F03		24.0		V
	AK60A-024L-240F04		24.0		V
Output voltage set point accuracy	T_C = +25˚C, $V_I = V_{Inom}$, $I_O = I_{Orated}$	-1		1	$\%V_{Onom}$
Remote sense compensation	$V_I = V_{Imin}$			0.5	V
Output voltage adjust		90		110	$\%V_{Onom}$
Nominal (factory set) output overvoltage protection trip point		120		140	$\%V_{Onom}$
Line regulation	V_{Imin} to V_{Imax}			0.2	$\%V_{Onom}$
Load regulation[1]	10% of I_{Omax} to I_{Omax}			0.5	$\%V_{Onom}$
Noise and ripple	20MHz bandwidth			3	$\%V_O$
Output current					
	AK60A-024L-050F10	1.00		10.00	A
	AK60A-024L-050F15	1.50		15.00	A
	AK60A-024L-050F20	2.00		20.00	A
	AK60A-024L-120F04	0.42		4.20	A
	AK60A-024L-120F06	0.63		6.30	A
	AK60A-024L-120F08	0.83		8.30	A
	AK60A-024L-150F03	0.33		3.30	A
	AK60A-024L-150F05	0.50		5.00	A
	AK60A-024L-150F07	0.67		6.70	A
	AK60A-024L-240F02	0.21		2.10	A
	AK60A-024L-240F03	0.31		3.10	A
	AK60A-024L-240F04	0.42		4.20	A
Output current limit	V_O dropped to 90% of V_{Onom}	105		125	$\%I_{Orated}$
Temperature coefficient	Per ˚C Baseplate temperature			0.02	$\%V_O$/˚C
Maximum Load Capacitance (PRI AUX left open)	RESISTIVE LOAD START UP				
	AK60A-024L-050F10		TBD		µF
	AK60A-024L-050F15		TBD		µF
	AK60A-024L-050F20		TBD		µF
	AK60A-024L-120F04		TBD		µF
	AK60A-024L-120F06		TBD		µF
	AK60A-024L-120F08		TBD		µF
	AK60A-024L-150F03		40		µF
	AK60A-024L-150F05		200		µF
	AK60A-024L-150F07		500		µF
	AK60A-024L-240F02		TBD		µF
	AK60A-024L-240F03		TBD		µF
	AK60A-024L-240F04		TBD		µF
Overtemperature shutdown	Baseplate temperature	88	95	100	˚C
Efficiency	$V_I = V_{Inom}$, $V_O = V_{Onom}$, $I_O = I_{Orated}$				
	AK60A-024L-050F10	81	82		%
	AK60A-024L-050F15	79	80		%
	AK60A-024L-050F20	78	80		%
	AK60A-024L-120F04	83	87		%
	AK60A-024L-120F06	84	86		%
	AK60A-024L-120F08	84	86		%
	AK60A-024L-150F03	84	86		%
	AK60A-024L-150F05	84	86		%
	AK60A-024L-150F07	83	84		%
	AK60A-024L-240F02	84	86		%
	AK60A-024L-240F03	85	86		%
	AK60A-024L-240F04	84	86		%

Notes :
1. If Pri Aux option is not implemented then minimum load of 10% is required to establish stable converter operation

Electrical Specifications for 48V Input Models *(AK60A-048L-xxxFyy)*

INPUT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Input voltage		36	48	72	V
Input surge voltage	continuous			75	V
Input low line power on voltage	Module power on	22.0		32.5	V
Input low line power off voltage	Module shutdown	20.0		28.0	V
Input capacitance				2.5	µF
Input current	Low line, nom V_O, max I_O				
	AK60A-048L-050F10		1.9		A
	AK60A-048L-050F15		2.8		A
	AK60A-048L-050F20		3.6		A
	AK60A-048L-120F04		1.8		A
	AK60A-048L-120F06		2.6		A
	AK60A-048L-120F08		3.4		A
	AK60A-048L-150F03		1.9		A
	AK60A-048L-150F05		2.7		A
	AK60A-048L-150F07		3.5		A

TRANSIENT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Units
Turn-on time	V_I = 0 to V_{Inom}			1	sec
Transient response	Step-load excursion			10	%V_O
(25% to 75% load change @ 0.1A/µS, recovery to 1% V_O)	Step-load response			500	µS

Electrical Specifications for 48V Input Models *(Cont'd)*

OUTPUT CHARACTERISTICS					
Parameter	**Conditions**	**Min**	**Typ**	**Max**	**Units**
Nominal (factory set) output voltage					
	AK60A-048L-050F10		5.0		V
	AK60A-048L-050F15		5.0		V
	AK60A-048L-050F20		5.0		V
	AK60A-048L-120F04		12.0		V
	AK60A-048L-120F06		12.0		V
	AK60A-048L-120F08		12.0		V
	AK60A-048L-150F03		15.0		V
	AK60A-048L-150F05		15.0		V
	AK60A-048L-150F07		15.0		V
Output voltage set point accuracy	T_C = +25˚C, $V_I = V_{Inom}$, $I_O = I_{Orated}$	-1		1	$\%V_{Onom}$
Remote sense compensation	$V_I = V_{Imin}$			0.5	V
Output voltage adjust		90		110	$\%V_{Onom}$
Nominal (factory set) output overvoltage protection trip point		120		140	$\%V_{Onom}$
Line regulation	V_{Imin} to V_{Imax}			0.2	$\%V_{Onom}$
Load regulation[1]	10% of I_{Omax} to I_{Omax}			0.5	$\%V_{Onom}$
Noise and ripple	20MHz bandwidth			3	$\%V_O$
Output current					
	AK60A-048L-050F10	1.00		10.00	A
	AK60A-048L-050F15	1.50		15.00	A
	AK60A-048L-050F20	2.00		20.00	A
	AK60A-048L-120F04	0.42		4.20	A
	AK60A-048L-120F06	0.63		6.30	A
	AK60A-048L-120F08	0.83		8.30	A
	AK60A-048L-150F03	0.33		3.30	A
	AK60A-048L-150F05	0.50		5.00	A
	AK60A-048L-150F07	0.67		6.70	A
Output current limit	V_O dropped to 90% of V_{Onom}	105		125	$\%I_{Orated}$
Maximum Load Capacitance (PRI AUX left open)	RESISTIVE LOAD STARTUP				
	AK60A-048L-050F10		5200		µF
	AK60A-048L-050F15		5200		µF
	AK60A-048L-050F20		16000		µF
	AK60A-048L-120F04		350		µF
	AK60A-048L-120F06		600		µF
	AK60A-048L-120F08		1800		µF
	AK60A-048L-150F03		180		µF
	AK60A-048L-150F05		400		µF
	AK60A-048L-150F07		440		µF
Temperature coefficient	Per ˚C Baseplate temperature			0.02	$\%V_O$/˚C
Overtemperature shutdown	Baseplate temperature	88	95	100	˚C
Efficiency	$V_O = V_{Onom}$, $V_I = V_{Inom}$, $I_O = I_{Orated}$				
	AK60A-048L-050F10	80	82		%
	AK60A-048L-050F15	80	82		%
	AK60A-048L-050F20	81	82		%
	AK60A-048L-120F04	84	87		%
	AK60A-048L-120F06	86	88		%
	AK60A-048L-120F08	86	88		%
	AK60A-048L-150F03	80	83		%
	AK60A-048L-150F05	82	84		%
	AK60A-048L-150F07	83	85		%

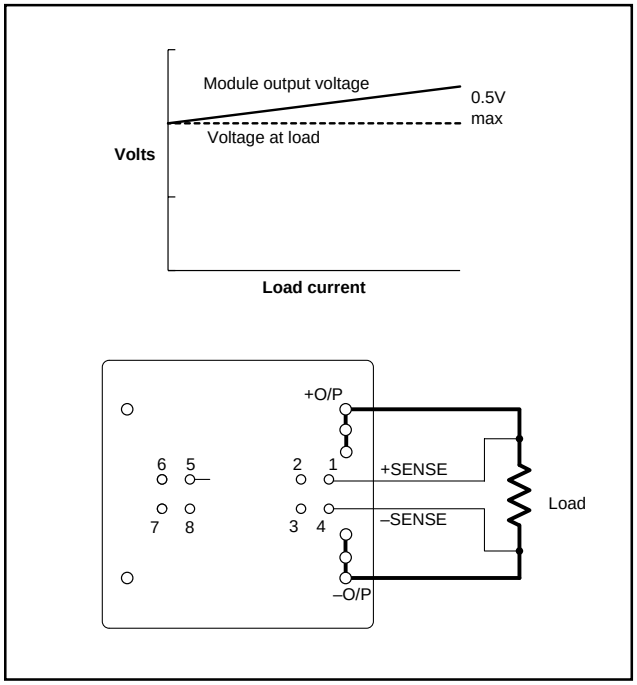
Notes :
1. If Pri Aux option is not implemented then minimum load of 10% is required to establish stable converter operation

Functional Description

This section explains how to implement the functions found on the AK60A series.

Remote Sense (+SENSE, -SENSE)

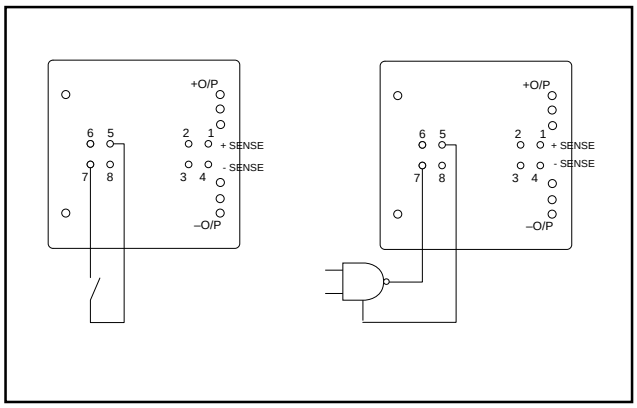
Connect the +SENSE and -SENSE pins directly to the load to allow the module to compensate for the voltage drop across the conductors carrying the load current. If remote sensing is not required (for example if the load is close to the module) the sense pins should be connected directly to the module's output pins to ensure accurate regulation.



Note: If the sense leads fail open circuit, the module will revert to local sense at the output pins. Incorrect connection of sense leads may damage the module

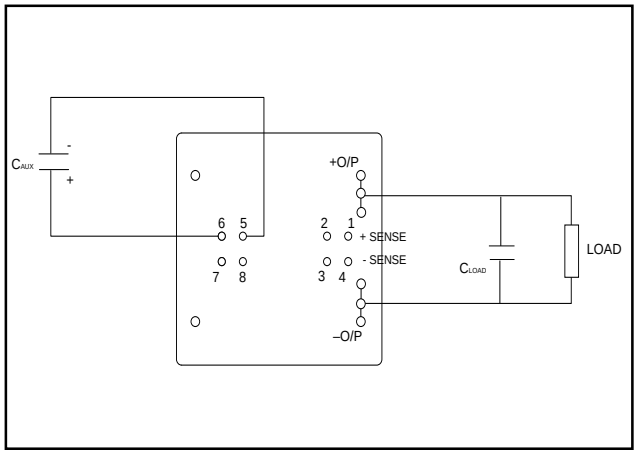
Enable Control (ENABLE)

The enable pin is a TTL compatible input used to turn the output of the module on or off. The module output is enabled when the ENABLE pin is connected to S COM or driven to a logic low of <0.8V (but not negative).
The output is disabled when the ENABLE pin is open or driven to a logic high >2V.



PRI AUX

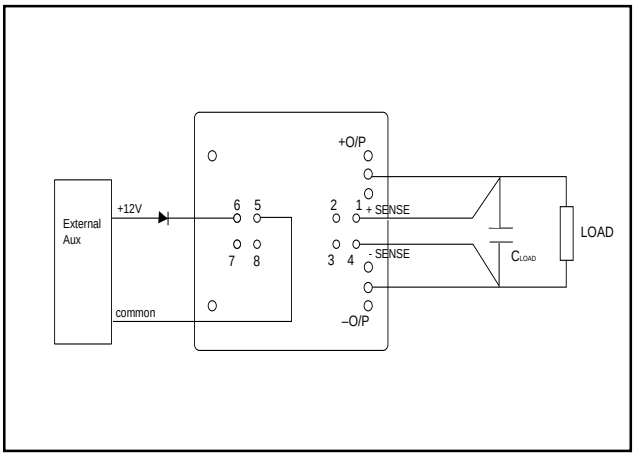
The ability of the AK60 to start highly capacitative loads can be extended by adding an external capacitor or adding an external auxiliary supply.



Maximum Load Capacitance

Model	C_{AUX}				
	None	100µF	470µF	1000µF	2200µF
AK60A-024L-050F10	TBD	TBD	TBD	TBD	TBD
AK60A-024L-050F15	TBD	TBD	TBD	TBD	TBD
AK60A-024L-050F20	TBD	TBD	TBD	TBD	TBD
AK60A-024L-120F04	TBD	TBD	TBD	TBD	TBD
AK60A-024L-120F06	TBD	TBD	TBD	TBD	TBD
AK60A-024L-120F08	TBD	TBD	TBD	TBD	TBD
AK60A-024L-150F03	40	940	1200	12250	26000
AK60A-024L-150F05	200	1440	6300	13500	21800
AK60A-024L-150F07	500	2500	8000	20000	35000
AK60A-024L-240F02	TBD	TBD	TBD	TBD	TBD
AK60A-024L-240F03	TBD	TBD	TBD	TBD	TBD
AK60A-024L-240F04	TBD	TBD	TBD	TBD	TBD
AK60A-048L-050F10	5200	28000	35000	>200000	>200000
AK60A-048L-050F15	5200	28000	35000	>200000	>200000
AK60A-048L-050F20	16000	45000	50000	>200000	>200000
AK60A-048L-120F04	350	1250	8800	15700	21500
AK60A-048L-120F06	600	2200	8800	15700	21500
AK60A-048L-120F08	1800	6400	22800	49200	99000
AK60A-048L-150F03	180	1100	5500	11000	28550
AK60A-048L-150F05	400	1330	7700	15700	35100
AK60A-048L-150F07	440	2200	15700	31800	49200

Alternatively an external auxiliary supply can be used.



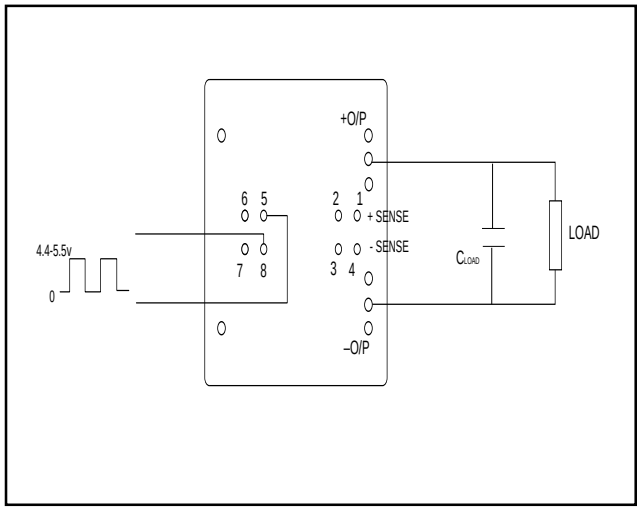
With an external auxiliary supply, the AK60A can be used with any value of Load capacitance.

CLK IN

The CLK IN function is available at Rev2 or above module

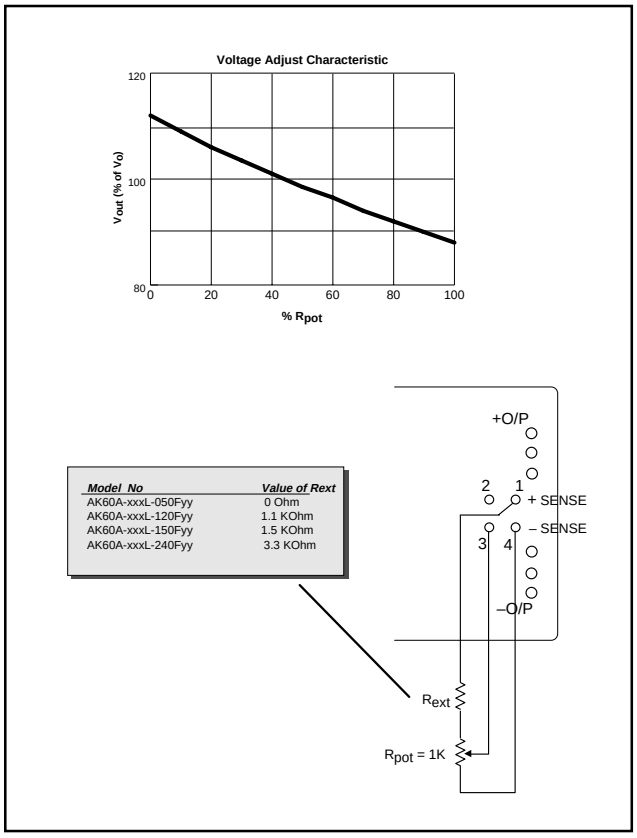
The CLK IN pin allows the AK60 to be synchronised to an external clock signal.

The clock signal is a 50% duty cycle square wave.



Output Voltage Adjustment (V ADJ)

The output voltage of the module may be accurately adjusted by up to ±10% of the nominal factory set output. Adjustment is carried out using a 1K Ohm trimming potentiometer connected as indicated.



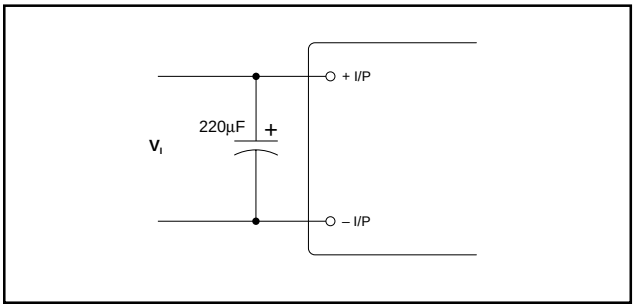
Model No	Value of Rext
AK60A-xxxL-050Fyy	0 Ohm
AK60A-xxxL-120Fyy	1.1 KOhm
AK60A-xxxL-150Fyy	1.5 KOhm
AK60A-xxxL-240Fyy	3.3 KOhm

Signal Common (S COM)

The S COM pin is the common signal return for all primary side controls.

Design Considerations

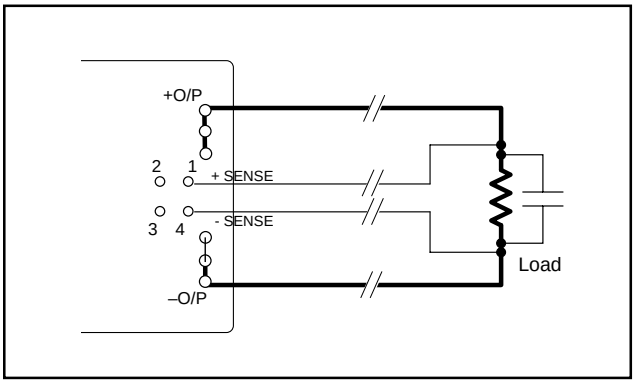
Input Bulk Capacitors



Electrolytic bulk reservoir capacitors placed close to the module input pins are recommended to ensure the module is fed with a low source impedance. For the AK60A Economy Series module typical values are 220µF/50V for 24V modules, 220µF/100V for 48V modules.

Remote Loads

If the sensed load is some distance from the module, the module's output voltage may rise sufficiently to trigger the OVP protection circuit during a step load change due to buss inductance. Fitting a decoupling capacitor at the load can reduce this effect.
It should be noted that a distributed power solution using *AMPSS* ™ modules placed close to their loads will optimize transient response.

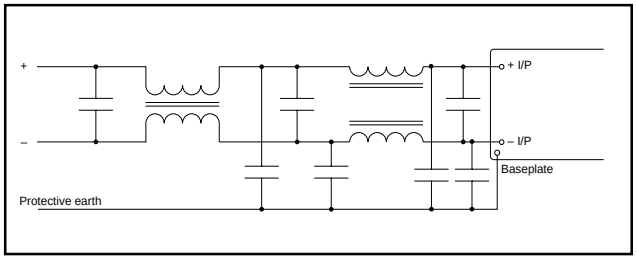


Input Undervoltage Protection

An input undervoltage protection circuit protects the module under low input voltage conditions. Hysteresis is built into the AK60A Enhanced Series module to allow for high levels of ripple on the input supply voltage without causing the module to cycle on and off. Typically 48V modules will turn on above 31V and turn off below 27V. 24V modules will turn on above 16.5V and turn off below 14V (see Electrical Specifications for exact figures).

Conducted EMI

Although AK60A Economy Series modules contain differential mode input EMI filtering, power supply systems using these modules will require additional EMI filtering to enable the system to meet relevant EMI standards.



AK60A modules have an effective input to ground (baseplate) capacitance of approximately 550pF. This should be accounted for when calculating the maximum EMI 'Y' capacitance to meet ground leakage current specifications.

Output Ripple and Noise

AK60A Economy Series modules are designed to generate very low ripple and noise. When mounted on logic boards, for example, sufficient decoupling is normally provided by the components used to decouple the logic ICs, and no additional decoupling is required.

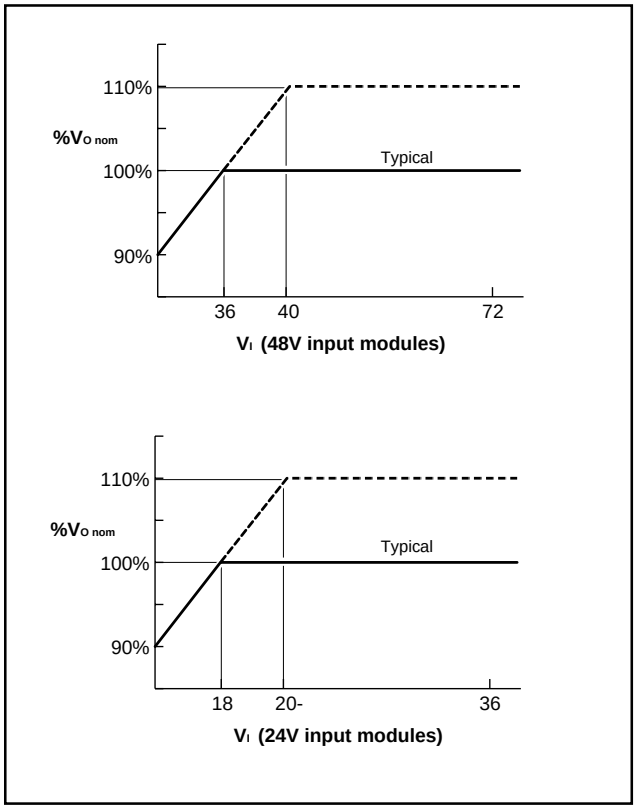
Input Fusing

AMPSS modules do not have an in-line fuse fitted internally. In order to comply with CSA, VDE and UL safety regulations it is recommended that a fuse of the following rating be fitted at the module's input.

Input	Fuse Rating
24V	15A / 250V
48V	10A / 250V

Break Regulation

AK60A Economy Series modules are designed to deliver full rated output current at up to 0.5V above $V_{O\ nom}$ at the minimum specified input voltage.



Overtemperature Protection

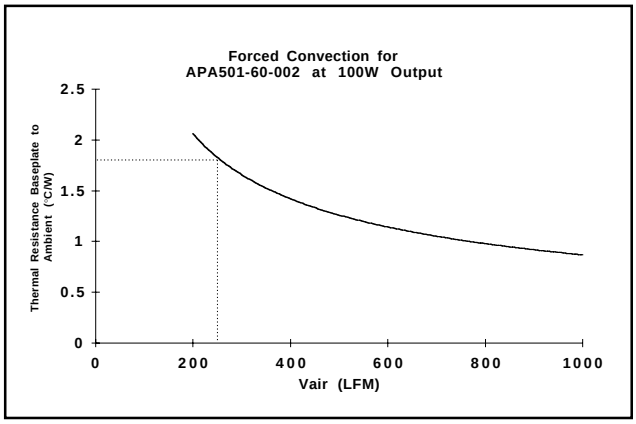
If the module's internal temperature exceeds 85°C, the module will protect itself by cycling on and off until the internal temperature drops below 85˚C. By adding an external auxiliary supply to the pri aux pin, the module will latch off and automatically switch on again when the internal temperature has dropped by 5-10˚C.

MTBF

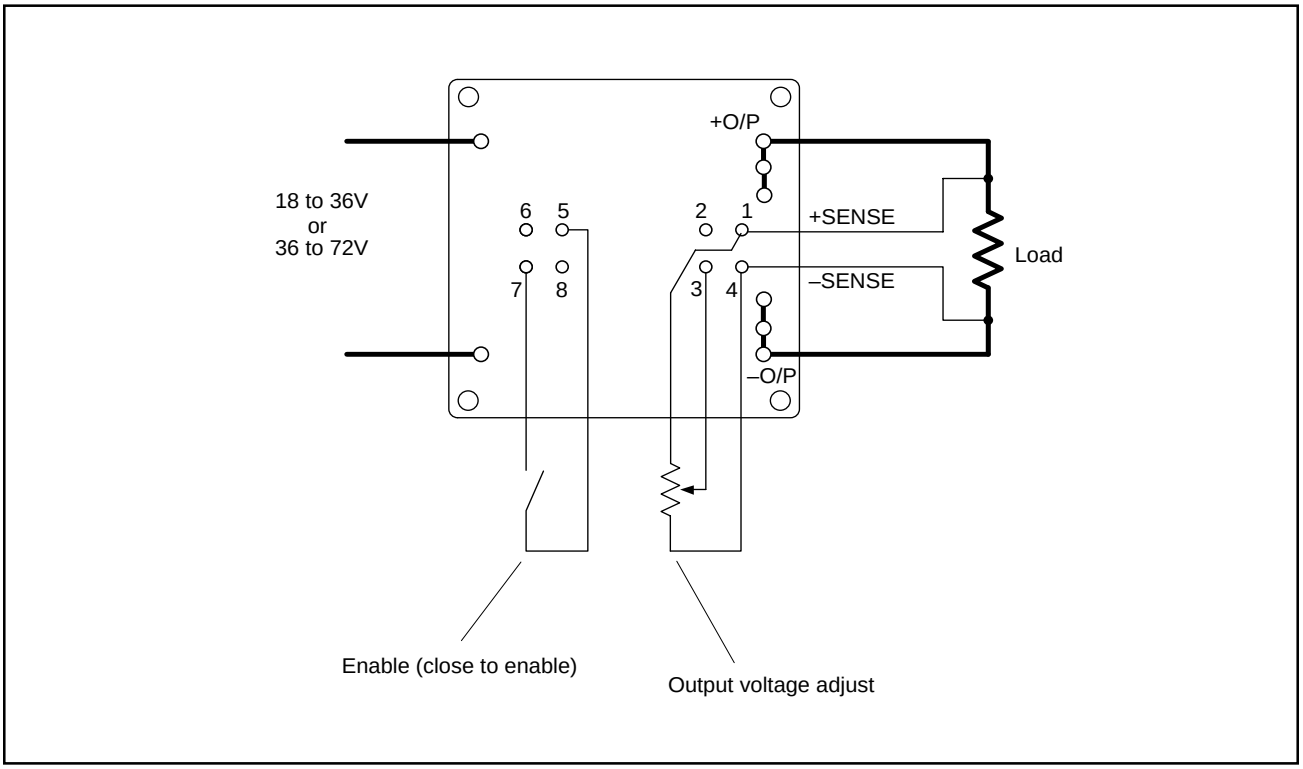
Predicted MTBF for the AK60A Economy Series is greater than 1,000,000 hours at maximum rated output and 50°C baseplate temperature.

Thermal Data

Natural convection thermal impedance of the AK60A package is approximately 4.4°C/W.
A standard horizontal fin heatsink available from Astec (part number APA501-60-002) with 11mm fins and 8mm pitch, will reduce module thermal impedance to 1.8°C/W with a forced air flow of (250 LFM) when mounted with a thermal pad (ASTEC P/N APA502-60-001) between heatsink and module.



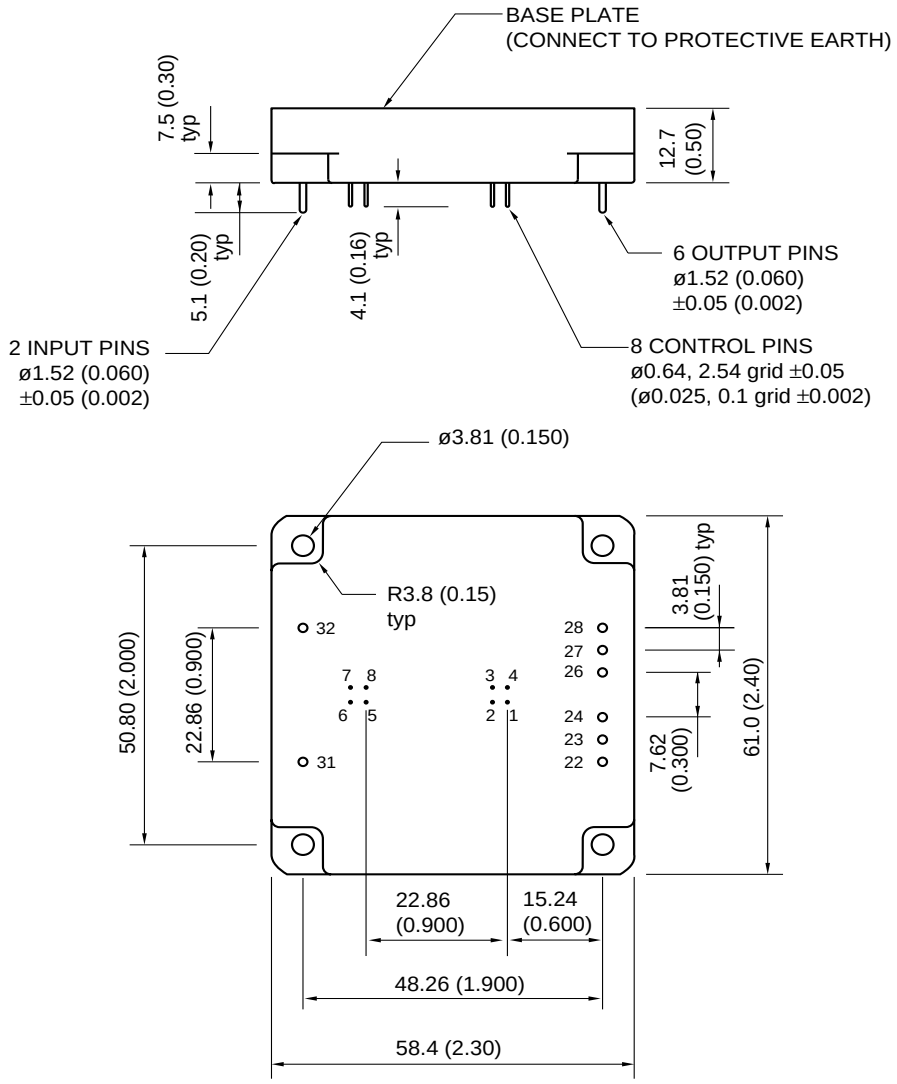
Application Example



Mechanical Information

Dimensions

The dimensions are given in mm (inches). Note that the baseplate must be connected to protective earth before power is supplied to the module.

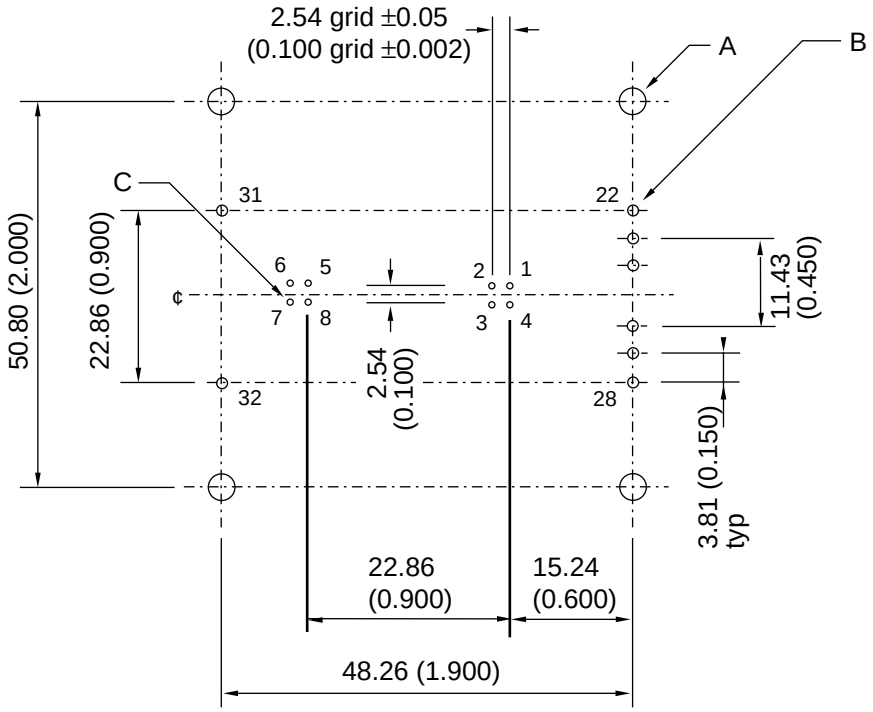


Notes:
1. All dimensions in mm and (inches)
2. Baseplate must be connected to protective earth
3. General tolerance: .X ±0.5 (0.02)
   .XX ±0.25 (0.010)
4. Surface Flatness: Concave 0.12mm max
   Convex 0.38mm max

Recommended PCB Layout

The AK60A module may be mounted to a board either by soldering or by using spring sockets.

Materials :
Control pins are tin plated phospher-bronze.
Input and output pins are tin plated copper.



VIEW FROM PCB COMPONENT SIDE

NOTES:
1. PCB COMPONENT SIDE VIEW IS SHOWN.
2. ALL DIMENSIONS IN mm AND (INCHES).
3. GENERAL TOLERANCE : .XX ± 0.1 (0.006).

RECOMMENDED HOLE SIZE TABLE :–

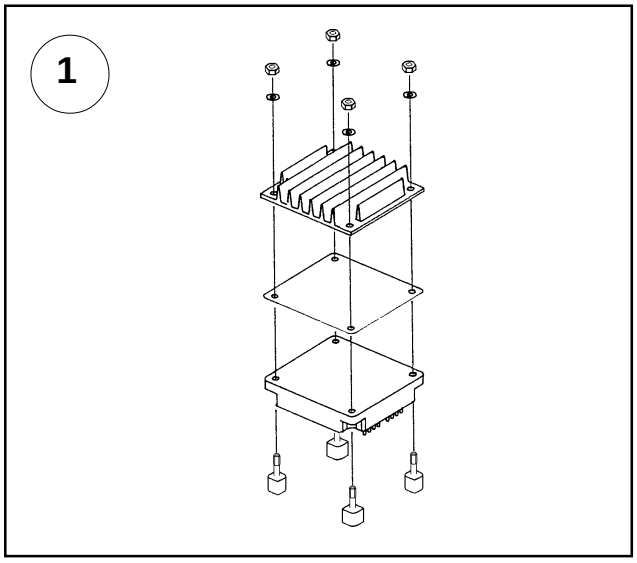
	A	B	C
HOLE SIZE FOR PCB DIRECT SOLDERING	ø2.0 + 0.15 / -0 (ø0.079 + 0.006 / -0)	ø2.0 +0.15 / -0 (ø0.079 +0.006 / -0)	ø1.00 +0.15 / -0 (ø0.039 +0.006 / -0)
HOLE SIZE FOR SPRING SOCKET MOUNTING*		ø2.67 ± 0.05 (ø0.105 ± 0.002)	ø1.37 ± 0.05 (ø0.054 ± 0.002)
HOLE SIZE FOR M3.5 MACHINE SCREW	ø4.5 +0.08 / -0 (ø0.177 +0.0031 / -0) FOR M3.5		

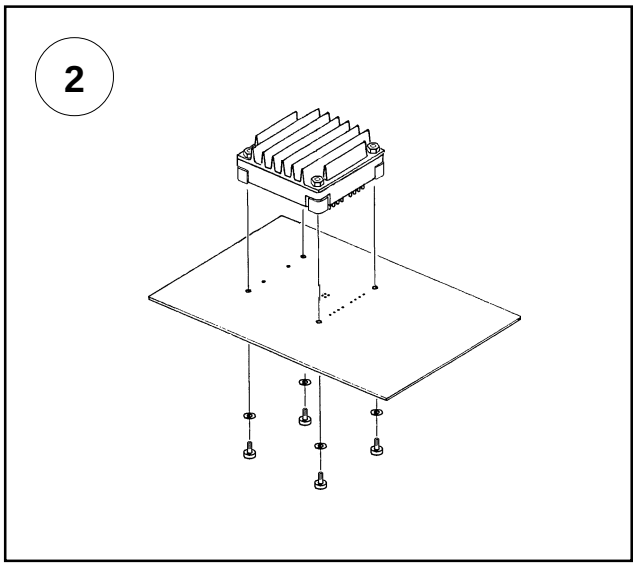
*Spring sockets are available from Astec in packs of 20 control pin sockets and 15 power pin sockets, part no. APA504-00-001. Sockets are not suitable for output current greater than 10A per pin.

Heatsink Mounting Information

Heatsinks for AMPSS™ modules are available in a variety of sizes and fin orientation. Mounting kits and thermal pads are also available. The table below shows the options available for AK60A Economy Series.
A heatsink mounting kit provides the most convenient way to mount the heatsink to the module and then mount the assembly onto a circuit board

AMPSS™ modules may be retained by their input and output pins only, or may be fixed to the board using bolts screwed into the tapped studs which are provided as part of the mounting kit. In both cases the studs provide clearance between the module and the circuit board to facilitate PCB cleaning operations.
Note: *baseplate and heatsink must be connected to protective earth*





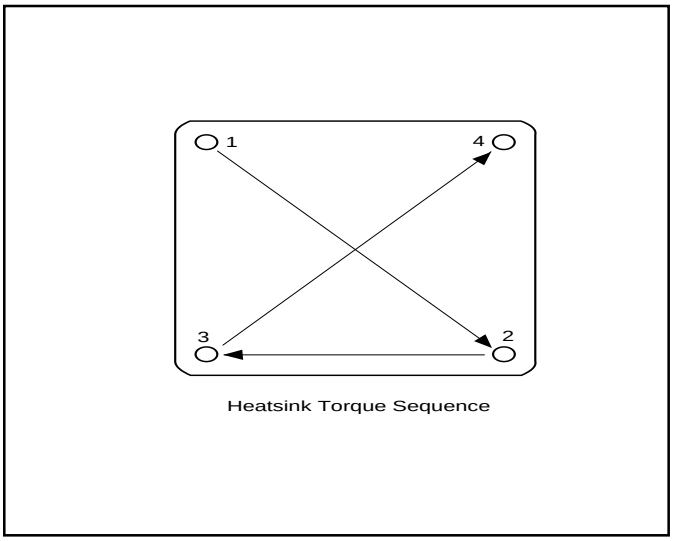
Description	Model Number	Dimensions		Free air thermal resistance
		inches	mm	
Heatsink, "60" size, vertical fin.	APA501-60-001	2.26x2.32x0.6	57.5x59x15	3.8˚C/W
Heatsink, "60" size, horizontal fin	APA501-60-002	2.26x2.32x0.6	57.5x59x15	3.9˚C/W
Heatsink, "60" size, vertical fin.	APA501-60-003	2.26x2.32x0.9	57.5x59x22.5	3.3˚C/W
Heatsink, "60" size, horizontal fin	APA501-60-004	2.26x2.32x0.9	57.5x59x22.5	3.7˚C/W
Heatsink, "60" size, vertical fin.	APA501-60-005	2.26x2.32x1.5	57.5x59x37	2.8˚C/W
Heatsink, "60" size, horizontal fin	APA501-60-006	2.26x2.32x1.5	57.5x59x37	2.8˚C/W
Heatsink, "60" size, low profile	APA501-60-007	2.25x3.50x0.5	57.2x89x12	3.6˚C/W
Thermal Pad, "60" size	APA502-60-001			
Mounting Kit, Tapped Studs	APA503-00-001			
Mounting Kit, Solder Studs	APA503-00-002			
Mounting Kit, Tapped Studs for low profile heatsink	APA503-00-007			
Mounting Kit, Solder Studs for low profile heatsink	APA503-00-008			
Spring Sockets (20 cont. 15pwr)	APA504-00-001			

To provide optimal thermal contact between heatsink and module, it is recommended that the mating surface of the heatsink should have a surface flatness of no greater than 0.1mm. The use of a thermal pad or thermal grease is also recommended.

The recommended torque of using AMPSS mounting kit for module/heatsink is:

Screw size	Torque
M3	4-6kg-cm (3.5-5.2 lb-in)
M3.5	6-8kg-cm (5.2-6.9 lb-in)

Torque sequence:



Heatsink Torque Sequence

It is assumed that all four mounting screws are being torqued to a common surface.

Other thermal management schemes are at customer discretion as long as the maximum thermal rating of the specific module is not exceeded.